Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

UNITED STATES
DEPARTMENT OF AGRICULTURE
DEPARTMENT CIRCULAR 341

Washington, D. C. February, 1925

SEED FLAX AS A FARM CROP IN 1925

By

A. C. DILLMAN
Associate Agronomist, United States Department of Agriculture

A. C. ARNY
Associate Agronomist, Minnesota Agricultural Experiment Station

CLYDE McKEE
Agronomist, Montana Agricultural Experiment Station

T. E. STOA
Assistant Agronomist, North Dakota Agricultural Experiment Station

and

A. N. HUME
Agronomist, South Dakota Agricultural Experiment Station

UNITED STATES DEPARTMENT OF AGRICULTURE

IN COOPERATION WITH THE MINNESOTA, MONTANA
NORTH DAKOTA AND SOUTH DAKOTA
AGRICULTURAL EXPERIMENT
STATIONS

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1925

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT

5 CENTS PER COPY

UNITED STATES
DEPARTMENT OF AGRICULTURE

IN COOPERATION WITH THE MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATIONS

DEPARTMENT CIRCULAR 341

Washington, D. C. February, 1925

SEED FLAX AS A FARM CROP IN 1925

By A. C. Dillman, *Associate Agronomist, United States Department of Agriculture;* A. C. Arny, *Associate Agronomist, Minnesota Agricultural Experiment Station;* Clyde McKee, *Agronomist, Montana Agricultural Experiment Station;* T. E. Stoa, *Assistant Agronomist, North Dakota Agricultural Experiment Station;* and A. N. Hume, *Agronomist, South Dakota Agricultural Experiment Station*

CONTENTS

	Page		Page
The present situation	1	The 1925 flax crop in North Dakota	9
The 1925 flax crop in Minnesota	4	Flax as a crop for South Dakota in 1925	11
Flax as a crop for Montana in 1925	7		

THE PRESENT SITUATION

From 1909 to 1921 the production of flaxseed in the United States decreased both in total quantity and in proportion to consumption. In the last three years of that period production was scarcely one-third of our requirements. The relatively low price of wheat in 1921 and 1922 and the recognized need for diversification in the spring-wheat belt led to an increase in the acreage of flax, beginning in 1922. Without regard to any effect of the wheat situation, seed flax has been a profitable crop during the past three years.

The result of these conditions has been a great increase in acreage of flax in the principal producing States. The area was increased from 1,113,000 acres in 1922 to 2,014,000 acres in 1923 and 3,289,000 acres in 1924. The increase was 81 per cent in 1923 and 63 per cent in 1924. In 1922 the acre yield was 9.3 bushels and the total production 10,375,000 bushels. In 1923 the acre yield was 8.5 bushels and the total production 17,060,000 bushels. The average acre yield in 1924 was 9.2 bushels, producing 30,173,000 bushels, the largest crop ever harvested in the United States. The average acre yield in the three years from 1922 to 1924, inclusive, was 9 bushels. In the five years from 1920 to 1924, inclusive, it was 8.1 bushels, and in the 10 years from 1915 to 1924, inclusive, it was 7.7 bushels.

CONSUMPTION IN THE UNITED STATES

The average annual consumption of flaxseed, including imports of linseed oil in terms of seed, during the 10-year period from 1911 to 1920, inclusive, was 26,733,000 bushels. The quantity consumed has

30775°—25†

increased greatly during the past four years. Consumption in 1921 (the year ended June 30, 1922) was 30,507,807 bushels. It increased to 38,242,000 bushels in 1922 and was 37,448,000 bushels in 1923.

It is estimated by commercial agencies that 40 million bushels of flaxseed will be consumed in the United States in 1924, the consumption year ending June 30, 1925. As shown in Table 1, the domestic production in 1924 was 30,173,000 bushels and the imports from July 1 to December 31, 1924, 5,124,033 bushels, a total of 35,297,033 bushels. These imports cover only the first half of the import year. In addition, it is reported that about 700,000 bushels are now (January, 1925) en route from Argentina and that more than 2 million bushels are in terminal storage in Canada awaiting import to the United States by water next spring. Linseed crushers and large users of linseed oil are of the opinion that in future the industry will require approximately 40 million bushels of flaxseed annually if present conditions of consumption continue. The production, net imports including linseed oil in terms of flaxseed, and the net supply available for consumption each year from 1911 to 1924 are shown in Table 1.

TABLE 1.—*Flaxseed production, net imports, including linseed oil in terms of seed, and net supply in the United States from 1911 to 1924, inclusive*

Year beginning July 1—	Production	Net imports [a]	Net supply	Year beginning July 1—	Production	Net imports [a]	Net supply
	Bushels	*Bushels*	*Bushels*		*Bushels*	*Bushels*	*Bushels*
1911	19,370,000	7,011,381	26,381,381	1918	13,369,000	8,368,020	21,737,020
1912	28,073,000	4,653,131	32,726,131	1919	7,256,000	24,706,304	31,962,304
1913	17,853,000	8,328,577	26,181,577	1920	10,774,000	16,743,049	27,517,049
1914	13,749,000	10,328,301	24,077,301	1921	8,029,000	22,478,807	30,507,807
1915	14,030,000	14,411,013	28,441,013	1922	10,375,000	27,867,514	38,242,514
1916	14,296,000	11,956,672	26,252,672	1923	17,060,000	20,388,044	37,448,044
1917	9,164,000	12,888,312	22,052,312	1924	[b]30,173,000	[c]5,124,033	[c]35,297,033

[a] Of linseed oil, 18¾ pounds are equivalent to 1 bushel of flaxseed.
[b] Preliminary estimate.
[c] Six months, July 1 to Dec. 31, 1924.

THE ACRE INCOME FROM FLAX

Flax is grown entirely as a cash crop. The chief competing crops are spring wheat and oats where oats are grown for market. In 1922 and 1923 the gross acre income, based on the December 1 farm price, was greater from flaxseed than from wheat or oats in the flax-producing States. In 1924, however, flax and spring wheat returned about the same income per acre. This is shown in Table 2.

TABLE 2.—*Value per acre of flaxseed, spring wheat, and oats in six States, based on the December 1 farm prices, 1922, 1923, and 1924*

State	1924			1923			1922		
	Flax	Wheat	Oats	Flax	Wheat	Oats	Flax	Wheat	Oats
North Dakota	$19.30	$19.53	$12.24	$16.32	$6.36	$6.44	$19.90	$12.69	$8.58
Minnesota	26.56	28.34	18.49	21.30	11.88	12.58	21.80	13.84	11.36
South Dakota	19.85	18.62	14.80	17.68	7.70	10.54	19.10	12.14	9.92
Montana	19.23	20.09	13.86	15.83	11.48	12.54	14.18	12.82	11.84
Iowa	26.32	21.84	18.92	19.74	11.48	13.39	19.24	14.16	12.98
Wisconsin	29.25	26.88	19.20	25.41	15.68	15.61	23.40	15.76	16.07

FLAXSEED PRICES AND THE TARIFF

The tariff act of 1922 provides an import duty of 40 cents per bushel on flaxseed (par. 760) and of 3.3 cents per pound on linseed oil (par. 54). A drawback (sec. 313), or refund, is provided, however, in case linseed cake or oil made from imported seed is exported. As the bulk of linseed cake is exported the drawback usually amounts to about 10 cents per bushel on imported flaxseed. Deducting this drawback, the net duty on flaxseed therefore is approximately 30 cents per bushel. In a general way this duty is reflected in the higher price paid to producers in the United States, as shown by comparing the average prices of flaxseed at Minneapolis and Winnipeg.

The effect on the price of flaxseed of a domestic crop approaching the domestic demand was apparent during the fall months of 1924. The price at Minneapolis during September averaged only about 5 cents per bushel higher than that at Winnipeg. This slight spread was due in part to speculative activity in the latter market, but it was in part a reflection of the fact that the 1924 production promised to equal the average consumption of the country for the past several years. As the season advanced, the spread between the two markets gradually increased, Minneapolis averaging 8 cents higher than Winnipeg during October, 27 cents higher during November, and about 41 cents higher during December, when the demand for flaxseed was very keen.

THE WORLD OUTLOOK

World production of flaxseed has been on the increase since 1921. Pre-war production, 1909 to 1913, averaged about 111 million bushels annually. The production of 1923 was estimated as about 125 million bushels and that of 1924 as 133 million bushels. World consumption also is increasing. Argentina, India, and Canada are the chief surplus-producing countries. The 1924–25 Argentina crop now (January, 1925) being harvested is forecast at 51,966,000 bushels, or some 6½ million bushels less than the crop of last year. This smaller Argentine crop and the present strong world demand for flaxseed should tend to keep the world price up. It must be remembered, however, that the present high prices for flaxseed are likely to stimulate the seeding of a larger acreage in Canada and Argentina as well as in the United States, which might cause reduced world prices. Even should the world price drop, the large estimated consumption in the United States should provide a favorable home market for the domestic flax crop of 1925, provided always that production does not too closely approach the domestic requirements.

CONCLUSIONS

The experience of 1923 in the overproduction of wheat is still fresh in the minds of growers and illustrates what may be expected if the production of flaxseed in the United States should exceed the domestic requirements. From present conditions it appears probable that prices for flaxseed in the United States will be on a relatively higher level than wheat prices during the next crop year, provided production does not exceed domestic requirements. Conditions appear to war-

rant maintaining in 1925 an acreage at least equal to that of 1924. There is indication, however, that a material increase in acreage, such as has occurred in each of the past two years, might result in overproduction and depress prices to the world-market level. It is possible that a moderate increase in acreage, up to 3½ million acres, may be justified. The area of flax in 1924 was 3,289,000 acres, so that a limit of 3½ million acres would allow a small increase of 211,000 acres in 1925. The possible increases suggested in the State recommendations total only 163,000 acres. With an acre yield of 9 bushels, which is the average for the three years from 1922 to 1924, inclusive, 3½ million acres would produce 31,500,000 bushels. This would equal about 83 per cent of the nearly 38 million bushels consumed annually during 1922 and 1923.

The leading flax-producing States in order of production are North Dakota, Minnesota, South Dakota, and Montana. Conditions in these States vary, and the experiment-station specialist of each State is best able to advise farmers regarding practices to be followed in growing flax. The specific recommendations herein given were prepared by the experiment-station agronomist of each State, who is responsible for the recommendations made.

THE 1925 FLAX CROP IN MINNESOTA

By A. C. Arny, *Associate Agronomist, Minnesota Agricultural Experiment Station*

The flaxseed crop of 8,117,000 bushels produced on 712,000 acres with an average yield of 11.4 bushels per acre was one of the most profitable enterprises for Minnesota growers in 1924.

To maintain flax as a profitable crop, caution must be used in planning for the 1925 crop. With the price outlook for the 1925 flax crop of the United States favorable, the Minnesota acreage of 1924 should at least be maintained. Any expansion in the acreage beyond that area should be undertaken with caution on land well suited to flax production. While a limited expansion seems justifiable, it should not exceed 20 per cent, or a total acreage for the State in 1925 of 854,000 acres.

The world situation regarding probable production of flaxseed in 1925 is discussed in the opening pages of this circular. Each farmer should study this statement carefully.

Particular attention should be given to the essentials of good flax cropping, in order that the yields per acre may be maintained or increased. Increased yields without proportionate increases in cost of production result in greater net profits per acre.

COST OF PRODUCTION IN MINNESOTA

The gross income per acre for wheat and flax, together with the cost per acre of producing each in three sections of the State, is given in Table 3.

TABLE 3.—*Comparison of the gross income and the cost of production per acre of wheat and flax in Minnesota in 1922, 1923, and 1924*

[Cost data prepared by G. A. Pond, Associate Professor of Farm Management, University of Minnesota]

Items of comparison	1924	1923	1922	Average
Gross income per acre:				
Wheat	$28.34	$11.88	$13.84	$18.02
Flax	26.56	21.30	21.80	23.22
Cost of production per acre:				
Wheat—				
Northwest section	14.67	14.60	15.50	14.92
Southwest section	15.98	15.99	16.56	16.31
Southeast section	16.20	16.92	17.45	16.86
Average	15.62	15.84	16.50	
Flax—				
Northwest section	15.17	16.80	16.80	15.84
Southwest section	18.52	19.75	19.83	19.37
Southeast section	17.14	18.43	18.50	18.02
Average	16.94	18.33	18.38	

The charge for land rental was $5 per acre in the northwestern and southwestern parts of the State and $6 per acre in the southeastern part. These costs of production may be adjusted for rent charges at other rates if it is so desired.

The data given in the table show that in 1923 and 1922 in each of the three sections of the State the costs of production per acre for wheat were greater than the gross income, while flax returned a fair profit per acre each of the two years. In 1924, owing to the favorable world market for wheat and the exceptionally high average yield per acre for spring wheat, this crop gave a higher net return per acre than flax.

BUY SEED NOW

The 1924 flax crop was marketed more rapidly than any to date, and the price has been advancing continually. As a consequence there is an unusually small part of the crop on farms at present from which the supply of seed for the 1925 crop may be secured. Prompt action therefore is necessary in order to make certain of an adequate supply of good seed. Good seed is free from admixtures of weed seeds of all kinds, high in germination, and of a high-yielding variety.

QUANTITY OF SEED TO PURCHASE

Increased yields of 1 bushel per acre have been secured in central and southern Minnesota in State-wide trials during the last two years from seeding 42 pounds of flaxseed per acre over seeding at the usual half-bushel rate, or 28 pounds. In the Red River Valley, however, one-half bushel of good seed has given as good yields as a higher rate of seeding.

SEED OF WILT-RESISTANT VARIETIES WORTH A PREMIUM

At the present time the greater proportion of the flax crop in Minnesota is necessarily grown on old land, with consequent greater damage from weeds and diseases than when it was grown on new land. Under these conditions the only assurance a grower can have that his crop will be comparatively free from wilt is to purchase from reliable sources seed of a variety having known resistance to this disease. Every one of the 3,000 available bushels of certified Winona seed should be purchased and sown on the best land available, in order that the most rapid increase possible of this particular variety may be secured for sowing in 1926. Chippewa and North Dakota Resistant No. 114, two other wilt-resistant varieties of proven worth, should be purchased even at a considerable advance in price over that asked for common seed of equal grade. Producing certified seed of wilt-resistant varieties for seeding purposes is proving a profitable undertaking.

A list of growers of certified flaxseed of the recommended varieties may be secured from the Minnesota Crop-Improvement Association, University Farm, St. Paul, Minn., and from the Northwest Experiment Station, Crookston, Minn.

BEST FLAX AFTER CLOVER OR CORN

Flax plants are not strong feeders and hence need a plentiful supply of available plant food and nitrogen in particular in the soil. This condition as well as comparative freedom from weeds is most often met following a crop of clover, mixed clover and timothy, or corn. Flax may also be grown to advantage following pasture or timothy-hay crops, but the indications are that it is injured more often by flax rust than when it follows the crops first mentioned.

SOWING EARLY REDUCES LOSS DUE TO WEEDS AND WILT

Wilt resistance in flax is only relative, and early seeding is necessary to secure the greatest freedom from the disease. This is true even when the best available wilt-resistant varieties are used.

Flax may be sown at the same time as the grain crops, wheat, oats, or barley, or immediately following with little or no danger from killing by frost. Early seeding practically eliminates such weeds as foxtail, barnyard grass, and redroot, or pigweed. Lambs-quarters, bindweed, wild oats, and perennial weeds are not controlled by early seeding. Seedings made later than corn-planting time usually average considerably lower in yield than seedings made before or at that time.

FLAX AND WHEAT A DESIRABLE COMBINATION[1]

A combination of wheat, 30 to 45 pounds, and flax, 42 pounds per acre, mixed in the granary and sown at wheat-seeding time has several advantages over flax sown alone, particularly in the control of such weeds as lambs-quarters and bindweed. Growing the two crops in combination has several other advantages. In many instances the combination crop gives a higher relative yield than either crop alone considered as 100. The combination crop is as

[1] See Minnesota Agricultural Experiment Station Bulletins Nos. 204 and 206. These bulletins may be obtained from the Division of Publications, University Farm, St. Paul, Minn.

easy to handle as a pure wheat crop, and if one of the crops in the combination is injured or made practically a total failure by a disease peculiar to it the other is there to produce at least a partial crop. The mixed crop was profitable in 1923, even though the wheat in some locations was badly damaged by stem rust.

There are two disadvantages in growing the combination crop. The cost of separating the seed on the farm before it is marketed offsets to some extent the advantages. However, with a separating machine of good size, which may be constructed at home by following blue prints obtainable from the Division of Agricultural Engineering, University Farm, St. Paul, Minn., the task of separating is not arduous or expensive. Carload lots of the combination crop can be sold through the local elevators, shipped to the terminals, and separated there.

The other disadvantage is that the mixed flax straw can not be used by the industries in the State, which use approximately 200,000 tons annually in the manufacture of various fiber products. Up to the quantity needed by these industries, dry flax straw reasonably free from weeds on farms within 150 miles of the markets has a value of approximately $3 per ton in the stack. Baling and hauling give employment at fair wages in the winter season.

CUT WHEN FULLY MATURE

The seeds of flax increase in weight and oil content up to the time the plants turn a golden brown. There is no advantage in letting the crop stand after that state is reached. The crop is cut with a binder and the bundles set in narrow shocks of 10 to 12 pairs of bundles each.

FLAX AS A CROP FOR MONTANA IN 1925

By Clyde McKee, *Agronomist, Montana Agricultural Experiment Station*

Montana's present flax acreage is not up to the average. In 1924 the farmers of this State grew 270,000 acres of flax. This was less than the average area of 291,000 acres for the 10-year period from 1915 to 1924, inclusive. The largest flax acreage ever harvested in Montana was 547,000 acres, in 1918. The smallest acreage since 1910, when flax became one of the major crops of the State, was the crop of 1922, which was 84,000 acres.

It seems safe to suggest that Montana growers bring their flax acreage in 1925 up to the 10-year average given above. This means an increase of approximately 8 per cent over the area sown in 1924, or a total of 291,000 acres for the State. To increase the acreage materially above normal if accompanied by similar increases in other States and a favorable season for flax would undoubtedly result in overproduction and a drop in prices.

The world situation regarding the probable production of flaxseed in 1925 is discussed in the early pages of this circular. Each farmer should study this statement carefully.

ACRE YIELDS OF FLAX ARE LOW

The flax growers of Montana should strive for higher acre yields, in order to overcome the handicap of long hauls and high freight rates. While a slight increase in acreage is recommended for next

year, growers are more particularly urged to give attention to the principles of good flaxseed production. Approved cultural methods and efficiency in all operations should be emphasized, as increased yields without a proportionate increase in the cost of production result in greater net profits per acre.

Weeds are probably the greatest enemy of flax and responsible for most of the low yields. The two weeds that do most of the damage in Montana are the Russianthistle and "Jim Hill," or tumbling mustard.

FLAX ON OLD LAND

The day of flax on breaking is largely past and from now on much of Montana's flax will be grown on old ground. So far as possible flax should be sown only on clean ground. It is unsafe to seed flax until the weed seeds have sprouted and then have been killed by cultivation. Early spring cultivation and slightly delayed seeding are becoming more and more common in the summer-fallow practice in northern Montana and southern Alberta and Saskatchewan. Flax has about the same resistance to dry weather as spring wheat and responds as well to good cultural methods.

SUMMER FALLOW OR CORNLAND BEST FOR FLAX

The best crops of flax in Montana will be raised on clean summer fallow or on cornland. Even though the summer fallow was kept clean during the previous season, the land is likely to be well seeded to Russianthistle and mustard by winds during the winter and early spring months.

Early in the spring the land should be cultivated with some type of tillage implement which will mix weed seeds with the soil and hasten their germination. As soon as a crop of weeds shows above the surface of the ground, cultivate again with a shallow cultivator, such as a duck-foot weeder or one of the various kinds of blade or rod weeders. After the land has been thoroughly cleaned the flax should be sown at the rate of about 20 pounds of clean seed per acre.

Cornland is usually prepared by thorough disking, to loosen and level the surface soil and to start the germination of any weed seeds which may be present.

FLAX ON BREAKING

Flax does well on breaking, and most Montana farmers are familiar with the essentials of raising a good flax crop on newly broken land. These essentials are: (1) Early breaking, about 4 inches deep; (2) packing of the furrow slices of sod firmly, so there are no air spaces between the sod and the bottom of the furrow; and (3) working up sufficient soil on top to fill in the cracks so the land will not dry.

FLAX ON IRRIGATED LAND

Montana farmers who have raised flax on irrigated land generally obtain satisfactory results. Flax yields heavily, fits well into a rotation, and is a good nurse crop for alfalfa and grasses. Experimental evidence available indicates that the flax acreage on irrigated lands of the State could be increased to advantage.

VARIETIES AND SEED

County agents are in touch with seed supplies and can inform farmers where they can obtain seed of the adapted varieties. Those

particularly recommended are Reserve (N. Dak. 155) for new land and North Dakota Resistant No. 52 or North Dakota Resistant No. 114 for old land.

FLAX-WHEAT MIXTURES NOT DESIRABLE IN MONTANA

Much of the flax in Montana is grown on nonirrigated land where moisture is often the limiting factor in crop production. Experiments with flax-wheat mixtures in this State strongly indicate that there is no advantage in sowing a mixture of flax and spring wheat, as is the practice in more humid sections, such as Minnesota.

THE 1925 FLAX CROP IN NORTH DAKOTA

By T. E. Stoa, *Assistant Agronomist, North Dakota Agricultural Experiment Station*

The area cropped to flax in North Dakota in 1924 was 1,732,000 acres, an increase of 65 per cent over 1923 acreage. The average acre yield of flax was 8.5 bushels, producing 14,722,000 bushels, or about one-half the flaxseed produced in the United States. Rainfall and temperature were favorable to production in 1924, and good yields generally were obtained. Seven other States where flax is grown, including Minnesota and South Dakota, produced larger acre yields than North Dakota. While the outlook at this time is favorable for a continued good market, North Dakota growers, in order to guard against the overproduction of flaxseed, should go slow about increasing further their flax acreage in 1925. Increased yields per acre without proportionate increases in cost of production will return greater net profits.

Competition from weeds and reduced stands due to wilt and drought are the outstanding problems that influence flax yields. The development of wilt-resistant varieties has greatly reduced the destructiveness of wilt. North Dakota Resistant No. 114 is the most wilt-resistant variety commercially available and should be grown on all old land where the disease may already be present in the soil. Losses in yield due to reduced stands because of wilt occur to a greater or less extent every year. To guard against such losses the use of the most resistant variety available is recommended. North Dakota Resistant No. 52 may be grown on land where wilt is not present.

Flax is not a vigorous plant and can not grow and produce to advantage among weeds. To produce the most profitable yields, flax should be seeded on land where weeds and weed seeds are not abundant. Sod from hay or pasture land, preferably where legumes have been grown and where weed seeds have had a chance to rot, is to be preferred. Clean cornland or fallow land is good. Seeds of wild oats from previous cropping may lie in the soil for one or more years without germinating, making it important to guard against the general presence of these weed seeds in the soil. In parts of the State subject to drought, sod crops, especially alfalfa, may draw so heavily on the moisture in the soil as to reduce it to the minimum. Under such conditions a tilled crop should follow the sod and flax preferably follow the tilled crop, which tends to conserve moisture. In western North Dakota, where tumble weeds, such as Russianthistles, blow over the land in the fall, winter, and early spring, clean land may quickly become infested with these weeds. Spring plowing aids

in the control of weeds and is a favored practice in western North Dakota for Russianthistle. On the heavier soils of eastern North Dakota spring plowing, while it aids in the control of weeds, is less desirable, because it is more difficult to work down into a good seed bed. In all cases a firm seed bed is desirable for flax.

TIME TO SEED

Early sown flax will better withstand the wilt disease and the high temperatures of July and August and consequently will yield better, other things being equal. Early sown flax put in immediately after seeding spring wheat will generally mature ahead of pigeon grass. Russianthistle and wild oats, however, germinate about as early as flax. Delayed seeding, in order to germinate and destroy weeds, is advisable on land infested by these weeds if this land is to be seeded to flax.

RATE TO SEED

In eastern North Dakota sow flax at 2 pecks (28 pounds) per acre. In central and western counties 20 pounds generally is sufficient. On weedy lands, however, and where diseases are a factor, a slightly heavier rate is advisable.

FLAX-WHEAT MIXED CROPPING

This method of cropping is not yet common in North Dakota, but is common in southern Minnesota. Observations on the mixed crop under North Dakota conditions during the past two years indicate that the advantage of this practice, as compared to flax alone, is that it encourages more early seeding of flax, resulting in better yields. The mixed crop is easier to harvest, dries and threshes better, and because of early seeding is ready to thresh at the time of threshing other grains. The wheat in the mixture also aids in the control of weeds to some extent. The mixed crop also has disadvantages. Flax and wheat must be separated after threshing. This, however, may be done at leisure on the farm, using an ordinary fanning mill. Carload lots of the mixed crop can be sold through the local elevators, payment being made on the basis of the proportion of each grain in the mixture less cost of separation. The mixed flax and wheat straw has no commercial value, and where there is a market for pure flax straw this must be considered.

Limited observations made in North Dakota do not indicate any substantial increase in total yield where the mixture has been grown. The relative prices for flax and wheat at marketing time determine the value of the mixed crop as compared to either of the crops seeded separately. In 1923 flax alone, where the crop was not subjected to excessive weed competition, was more profitable than the mixture, and the mixture was more profitable than wheat, because of the relatively higher price for flax than for wheat. In 1924 the yields of wheat were very good, and, with the favorable price for wheat, wheat alone was more profitable than the mixture and the mixture usually more profitable than flax alone.

The observations made do not warrant a general recommendation of the mixed crop under North Dakota conditions. Farmers, however, are justified in trying the mixed crop, particularly in the eastern part of the State, where moisture is favorable, and on land so infested with weeds that seeding of flax alone is inadvisable. In such mixture

the flax should be seeded at the regular rate, to which from 1 to 2 pecks of wheat should be added. The more wheat used the lower will be the flax yield. Where flax is considered the important crop in the mixture, only enough wheat to check the weeds should be added. Where 2 pecks of wheat are not sufficient to control the weeds the land can hardly be considered fit for flax.

FLAX AS A CROP FOR SOUTH DAKOTA IN 1925

By A. N. Hume, *Agronomist, South Dakota Agricultural Experiment Station*

South Dakota ranks third among the States in the acreage and production of flaxseed, being exceeded by North Dakota and Minnesota.

The area of flax in South Dakota, which averaged 177,000 acres in the five years from 1918 to 1922, inclusive, increased to 284,000 acres in 1923 and to 483,000 acres in 1924. Production increased from 1,404,000 bushels in 1921 to 2,414,000 bushels in 1923 and 4,299,000 bushels in 1924. The average acre yield of 8.9 bushels in 1924 had an acre value of $19.85, based on the December 1 farm price of flaxseed.

It appears desirable to maintain in 1925 an acreage of flax equal to that of 1924. Any increase in acreage should be made with caution and only on land that is well adapted to flax. The individual grower will do well to obtain clean wilt-resistant seed and to sow reasonably early on land well prepared and adapted to flax.

It is intended here to give to farmers of South Dakota the best information available on methods of growing seed flax. Some unpublished experimental results on three phases of the subject are summarized: (1) Rate of seeding, (2) date of seeding, and (3) the mixed cropping of flax and wheat. The results of earlier experiments with seed flax, up to the end of 1915, at Highmore, Eureka, Cottonwood, and Belle Fourche, are reported in South Dakota Bulletin No. 169, a copy of which can be obtained by addressing the Director of the South Dakota Agricultural Experiment Station, Brookings, S. Dak.

VARIETIES OF FLAX

Experiments indicate that the wilt-resistant varieties, including North Dakota Resistant No. 114 (S. D. 688), North Dakota Resistant No. 52 (S. D. 29), and Primost (S. D. 25), are best for growing on old land in this State. It is important that growers obtain their seed from reliable sources having genuine wilt-resistant seed. The supply of such seed is limited.

PREPARATION OF THE SEED BED

Flax does well after corn, clover, sweet clover, or a pasture crop. It should not be sown on land foul with weeds and does not do well on gumbo soils. The land if spring-plowed should be firmed by disking or rolling, if necessary, to make a compact seed bed. The seed should be sown shallow, or about 1 inch deep. The final harrowing is better done just ahead of the drill rather than after seeding.

DATE OF SEEDING

After wilt-resistant seed has been obtained the next question is the best date of seeding. In South Dakota Bulletin No. 169 the following statement is made:

> Flax has been considered a tender plant, and is not usually seeded until after all danger of frost is past. It is not uncommon for a farmer to seed flax as late as June 15 and even then get a good crop. This is possible, not because of the late seeding, but in spite of it. Furthermore, flax is not as tender as is commonly believed, and seeding as early as April 15 is not only possible but is very desirable. Flax plants are able to withstand a considerable degree of cold after they have passed the two-leaf stage.

Further experiments conducted at Highmore since 1915 confirm the advantages of early seeding. During the nine years, 1914, 1915, and 1918 to 1924, inclusive, flax sown April 1 averaged 7.3 bushels, that sown April 15 averaged 11 bushels, that sown April 30 averaged 7.9 bushels, that sown May 15 averaged 8.5 bushels, and that sown June 1 (four years only) averaged 3 bushels per acre. Seeding on April 15 produced the highest yields in five of the nine years covered and seeding on April 1 the highest yields in two of the nine years. The results, therefore, show that at Highmore the optimum date of seeding flax is on or about April 15.

Similar results also have been obtained at Eureka and Cottonwood, where the yields obtained from seedings made on April 15 averaged higher than those from any later date. The average yields at Eureka over a period of 12 years, 1913 to 1924, inclusive, were 9.6 bushels from the April 15 seeding, 9.1 bushels from the May 1 seeding, 8.1 bushels from the May 15 seeding, 5.1 bushels from the June 1 seeding, and 3.6 bushels from the June 15 seeding. At Cottonwood during the 11-year period from 1913 to 1923, inclusive, the average yields from seedings made at intervals of two weeks from April 15 to June 15, inclusive, were 4.1, 3.5, 2.6, 0.5, and 0.6 bushels per acre, respectively. The results from all these experiments emphasize the very great advantage of early seeding on old land.

RATE OF SEEDING

Experiments in seeding flax at different rates, ranging from 10 to 20 quarts per acre, were conducted at Highmore for eight years, 1917 to 1924, inclusive. The highest average yield, 7.3 bushels per acre, was obtained from seeding 20 quarts (35 pounds) per acre. Yields of 5.8, 6.4, 6.6, and 6.3 bushels per acre were secured from seeding 10, 12, 15, and 17 quarts, respectively. Increased yields of nearly a bushel per acre were obtained from seeding 20 quarts (35 pounds) per acre, as compared with the lower rates of seeding. Not less than 20 quarts (35 pounds) of flax seed per acre should be sown on old land in central and eastern South Dakota.

FLAX AND WHEAT AS A MIXED CROP

Limited experiments in growing a mixture of flax and wheat in comparison with each crop seeded alone were conducted at Brookings in 1923 and 1924. A tenth-acre plat of flax, one of wheat, and one of the mixed crop were grown each year. Flax alone was sown at the rate of 2 pecks (28 pounds) per acre and wheat alone at 5

pecks per acre. The mixed crop was sown at the rate of 2½ pecks of wheat and 1 peck (14 pounds) of flax. Marquis spring wheat and North Dakota Resistant No. 114 flax were the varieties used.

In 1923 the acre yield of flax alone was 7 bushels and of wheat alone 5 bushels. The mixed crop produced 2.6 bushels of flax and 4.8 bushels of wheat per acre. In 1924 flax alone made 15.9 bushels and wheat alone 19.3 bushels per acre. The mixed crop yielded 6.9 bushels of flax and 15.5 bushels of wheat per acre. It is difficult to compare these yields directly. If we consider the yield of flax alone and of wheat alone each as 100, then the "relative yield" of the mixed crop was 133 in 1923 and 124 in 1924. From these experiments it appears that at Brookings somewhat higher relative yields may be expected from growing flax and wheat in mixture than from growing each crop separately.

The chief advantage in growing the mixed crop as compared with flax alone is in the control of weeds. Such weeds as foxtail or pigeon grass, barnyard grass, redroot (pigweed), lambs-quarters, and bindweed are less vigorous in the mixed crop than in flax sown alone. Wild oats, fanweed, and some other weeds, on the other hand, are not checked by the mixed crop.

The mixed crop is a partial insurance also against heavy loss from plant diseases, such as stem rust. In 1923, when black stem rust of wheat was destructive, the mixed crop generally was much more profitable than wheat. The earlier seeding of the mixed crop also is an advantage to the flax in the mixture, as emphasized in the paragraphs headed "Date of seeding."

In sowing the mixed crop the common farm practice is to mix at the granary equal quantities by measure or weight of flax and wheat and to sow the mixed grain at the rate of 55 or 60 pounds per acre. The drill may be set for seeding 3 pecks of wheat or a trifle more as a preliminary trial and can be adjusted as required. Sow shallow, or from 1 to 1½ inches deep.

The mixed crop can not be recommended for the drier portions of western South Dakota until further tests have been made.

LIST OF AVAILABLE PUBLICATIONS ON SEED FLAX

UNITED STATES DEPARTMENT OF AGRICULTURE

(Washington, D. C.)

Farmers' Bulletin 1328, Production of seed flax. 1924.
Department Bulletin 655, Influence on linseed oil of the geographical source and variety of flax.
Department Bulletin 1120, Investigations of heat canker of flax. 1922.
Department Bulletin 1306, Work of the Sheridan [Wyo.] Field Station for the seven years from 1917 to 1923, inclusive.

MINNESOTA AGRICULTURAL EXPERIMENT STATION

(University Farm, St. Paul, Minn.)

Bulletin 204, Wheat and flax as combination crops. 1923.
Bulletin 206, Wheat and flax as combination crops. 1924.

MONTANA AGRICULTURAL EXPERIMENT STATION

(Bozeman, Mont.)

Circular 22, Cropping to flax on new lands of semiarid land areas. 1913.

NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

(Agricultural College, N. Dak.)

Circular 23, Better flaxseed production. 1924.
Bulletin 178, Flaxseed production. 1924.

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

(Brookings, S. Dak.)

Bulletin 169, Flax culture in South Dakota. 1916.

○